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Aerodynamic Investigation of Gap Treatment- and Chassis Skirts Strategies for a Novel Long-Haul Vehicle Combination

Constantly lowering emissions legislation and the fact that fuel prices have increased tremendously over recent years,
have forced vehicle manufacturers to develop more and more energy-efficient vehicles. The aerodynamic drag is
responsible for a substantial part of the total driving resistance for a vehicle, especially at higher velocities; thus it is
important to reduce this factor as much as possible for vehicles commonly operating in these conditions. In an attempt to
improve transport efficiency, longer vehicle combinations are becoming more common. By replacing some of the shorter
vehicle combinations with longer combinations, the same amount of cargo can be transported with fewer vehicles; hence
there is large potential for fuel savings. The knowledge of the aerodynamic properties of such vehicles is somewhat
limited, and therefore interesting to study.
This paper deals with the aerodynamic properties of a novel vehicle combination, which has a total length of almost
32m, and consists of a tractor unit in combination with two semi-trailers, supported by a dolly in-between the trailers. This
vehicle combination was evaluated in terms of aerodynamic properties, by the use of numerical simulations in the form of
Computational Fluid Dynamics . Both the gap between the cargo-units and the irregular chassis of the trailers are
known areas of substantial energy losses; it has also been shown in previous studies that a lot of the drag reduction that is
created in the cab region is lost downstream. Hence it was of interest to investigate possibilities for improving these two
areas. Two approaches to improve the flow in the gap region were evaluated: coverage of the gap and elimination of the
gap. For the chassis treatment, chassis skirts were added along the entire vehicle combination. Eventually, these two
strategies were added to investigate their combined effect. In addition, a more practical solution of the gap treatment was
tested; a so-called gap-fairing system, which was applied to both semi-trailer units.
The results from the simulations showed that there is great potential for the two drag-reducing strategies used. The

combined gap treatment and chassis skirts were especially successful; the total drag coefficient was reduced significantly.
It was seen that the chassis skirts were far more efficient compared to gap treatment; as a consequence of blocking the
main part of the airflow at chassis level in yawed-wind conditions. The practical solution with a gap fairing was shown to
be efficient, if used for both semi-trailer units.

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